M Case, J Colquhoun, L Currey-Randall, R Galiaduk, K Miller, W Nicholas, I Parnum, M Puotinen, B Radford, M Stowar, B Vaughan, M Wakeford, S Whalan

North West Shoals to Shore Research Program

Characterising the Ancient Coastline Key Ecological Feature: Fish and benthic communities

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L. Currey-Randall

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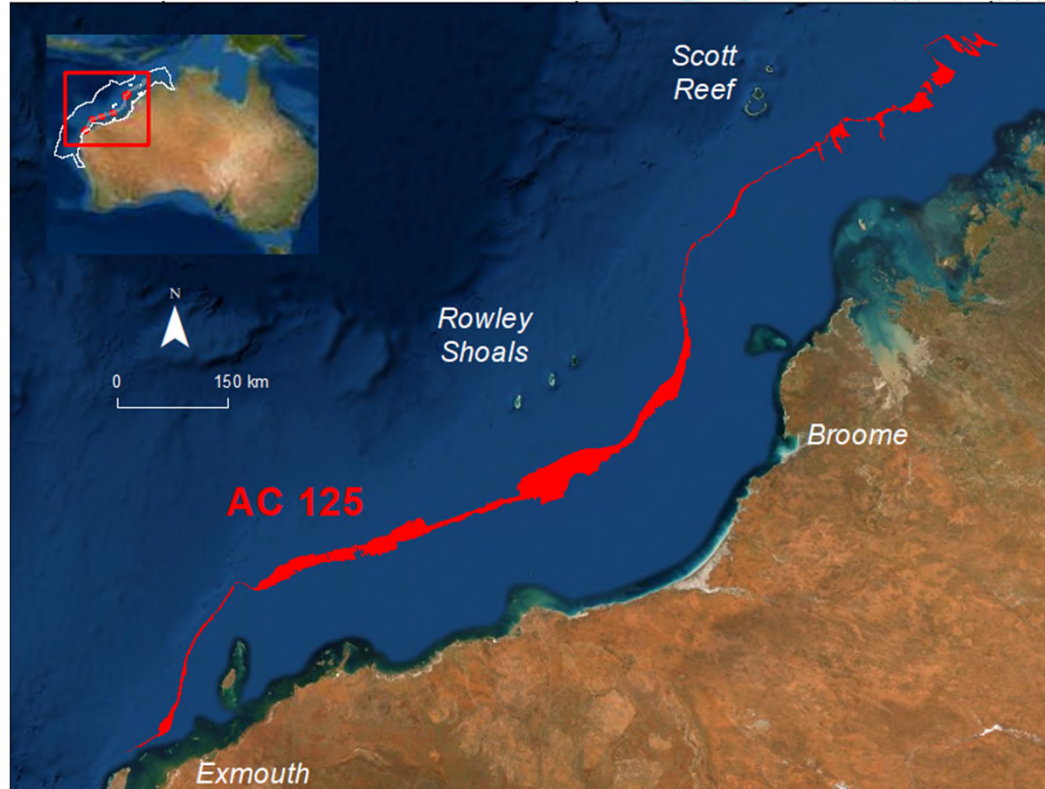AIMS: Australia's tropical marine research agency.
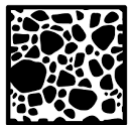
Ancient Coastline KEF at 125 m

Fish

Benthic habitats

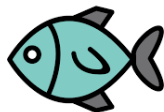Does hard substrate along the AC125 support benthic habitats & fish?
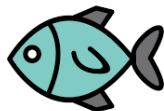
Research questions: Part 1

Is the AC125 dominated by hard substrate and high structural complexity?

Are benthic groups and habitats more abundant and diverse on the AC125 rather than in adjacent deeper or shallower waters?

Is fish abundance, diversity and richness greater on the AC125 rather than in adjacent deeper or shallower waters?

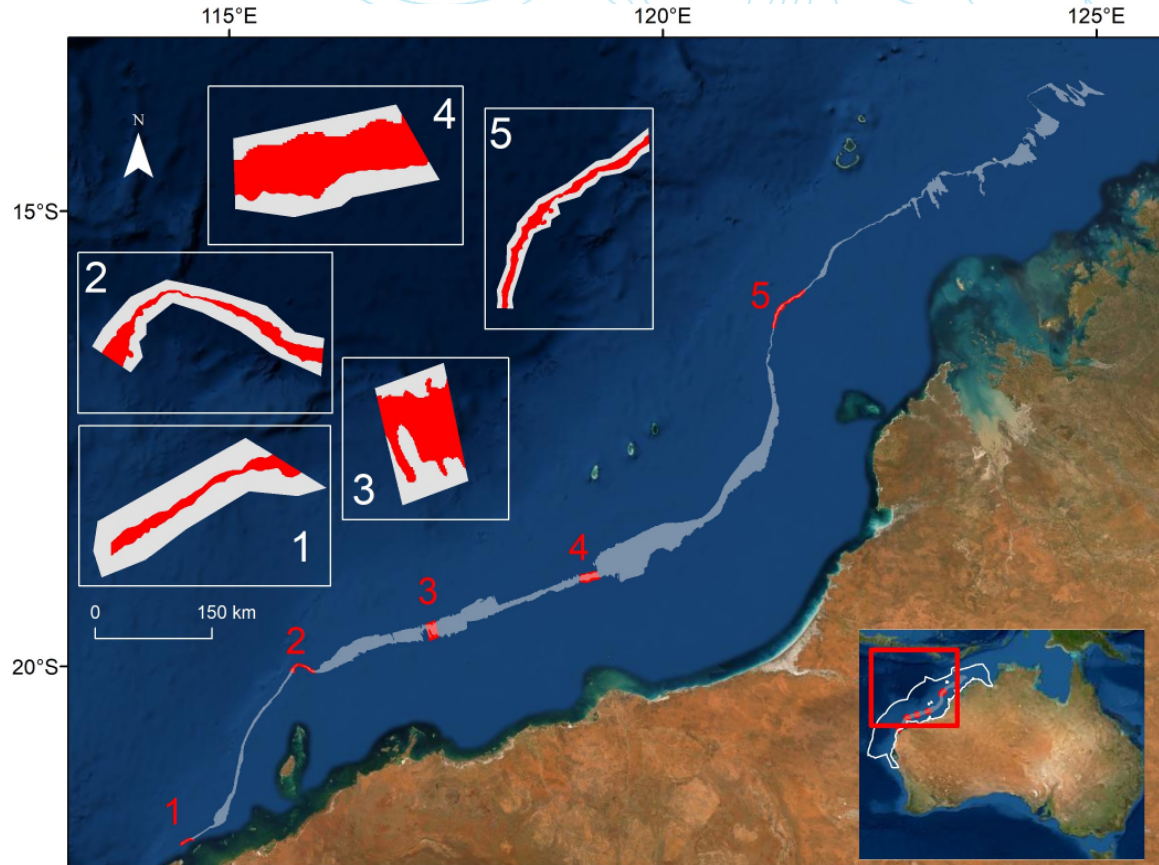Are fish species of fisheries and conservation importance found on the AC125?

Ancient Coastline KEF at 125 m

- 5 study areas along a latitudinal gradient

- Areas both in the defined KEF and on either side of it

- Areas both simple (3, 4) and complex (1, 2, 5).

- Multibeam, towed video, sediment grabs, BRUVS
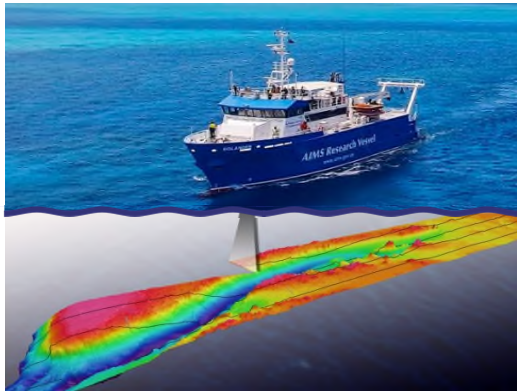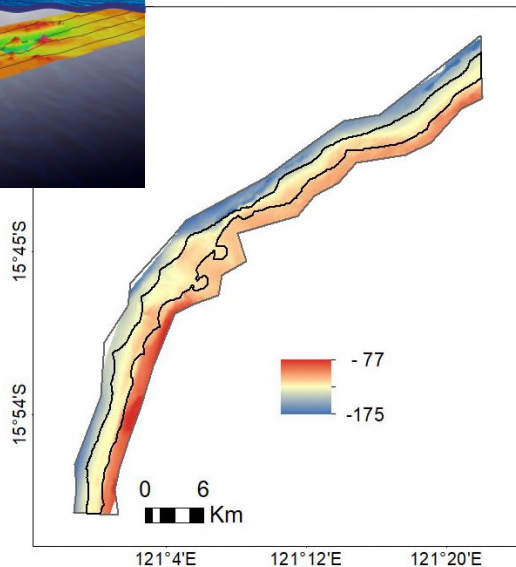
- Statistical and spatial models

Methods

Multibeam sonar used to map depth across the study areas

Depth & sediment grabs

Sediment grabs used to characterise the composition of the sea floor
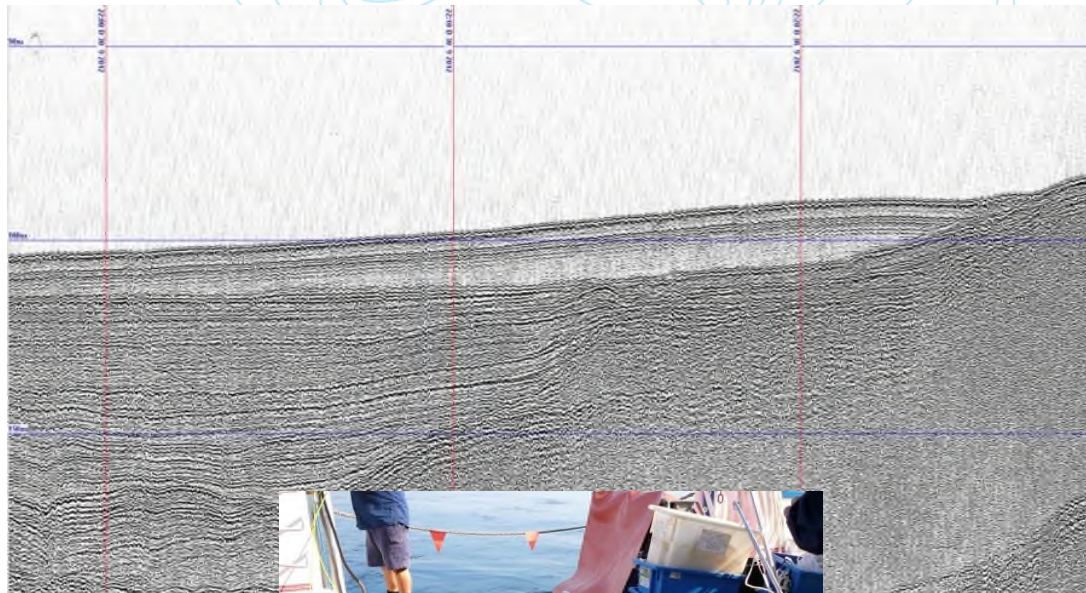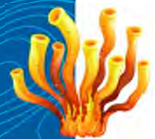
Methods

Sub-bottom profiling systems use sound to identify the layers and structure of the rock or sediment _beneath_ the seafloor.

We used existing profiles in Areas 3 and 4 to ask whether parts of the ancient coastline could be buried.
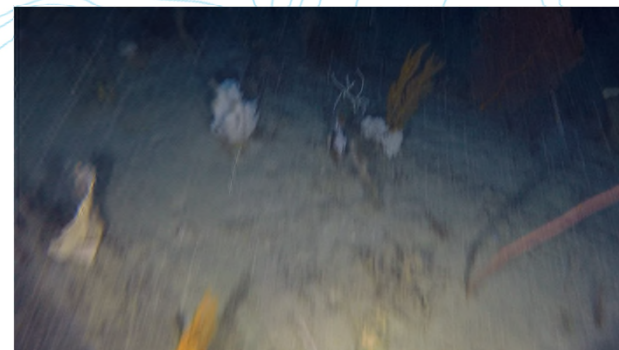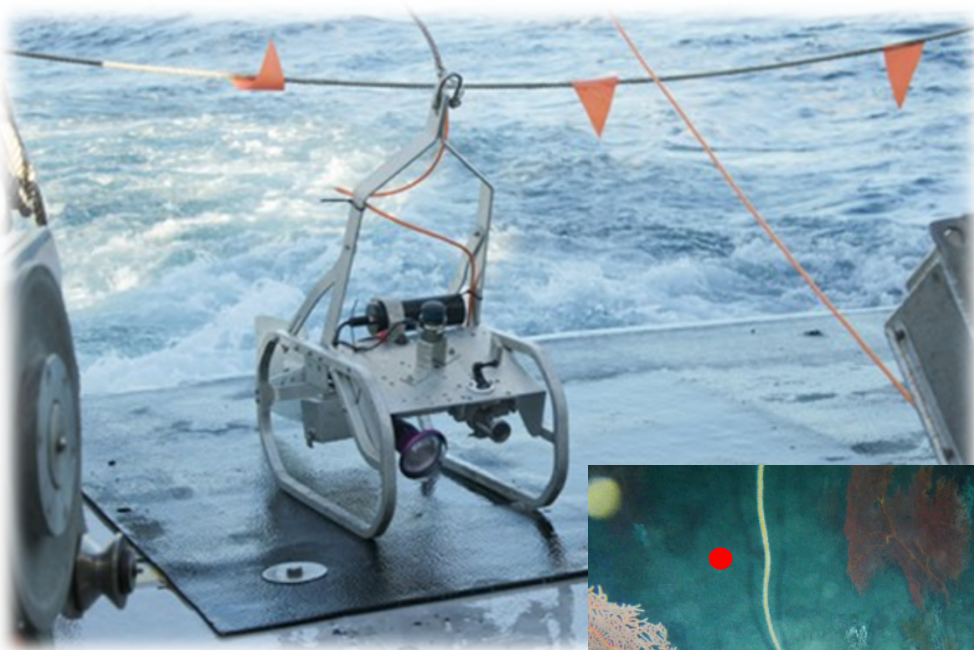
Methods

- 'Real-time' expert assessment of habitat types along each transect

- Detailed expert analysis of still photographs taken along each transect, with habitat identified at 5 points on each image

Methods

- Is there a gradient in diversity and abundance of biota with latitude?

- Are biota more likely to be found on the KEF or in adjacent shallow or deep areas?

  - 14 fine-scale benthic groups
  - Bray-Curtis similarity matrices
  - Hierarchical cluster analysis and SIMPROF test
  - nMDS ordinations
  - Multivariate analyses in PRIMER 7 with PERMANOVA+, 999 permutations
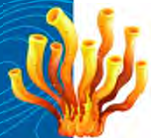 - Multiple sets of pairwise comparisons

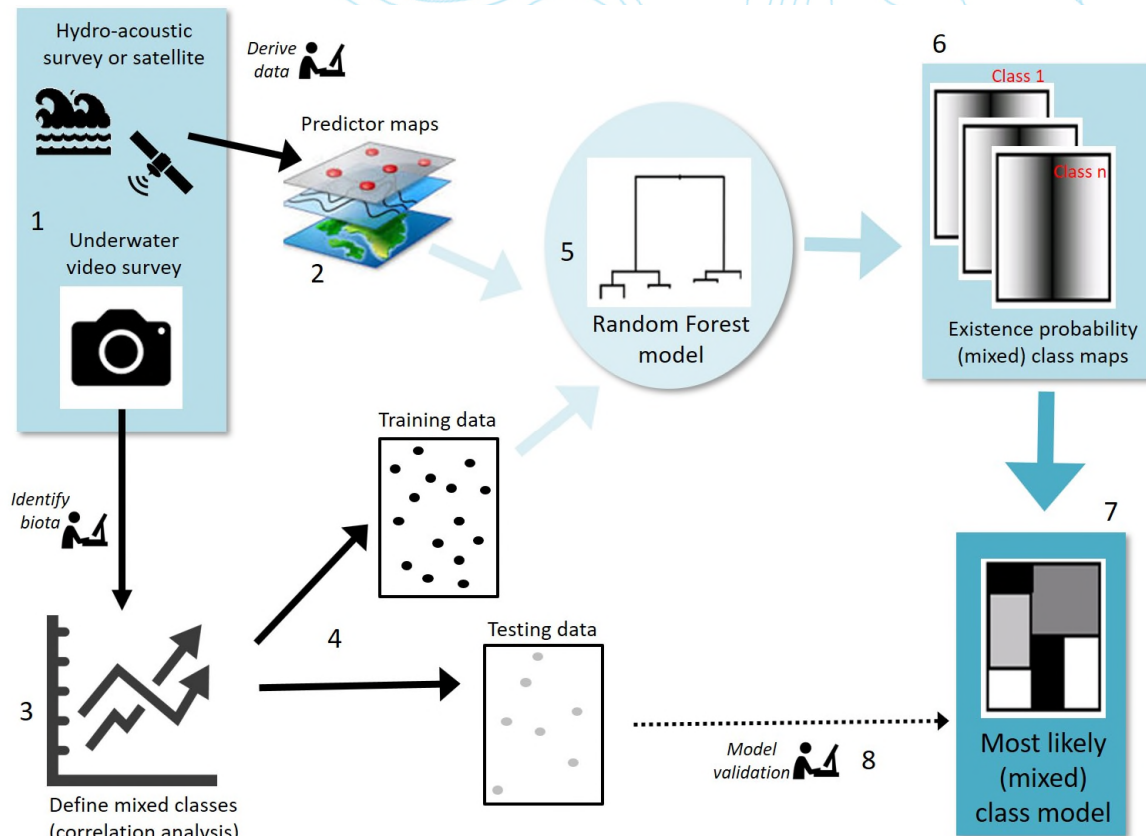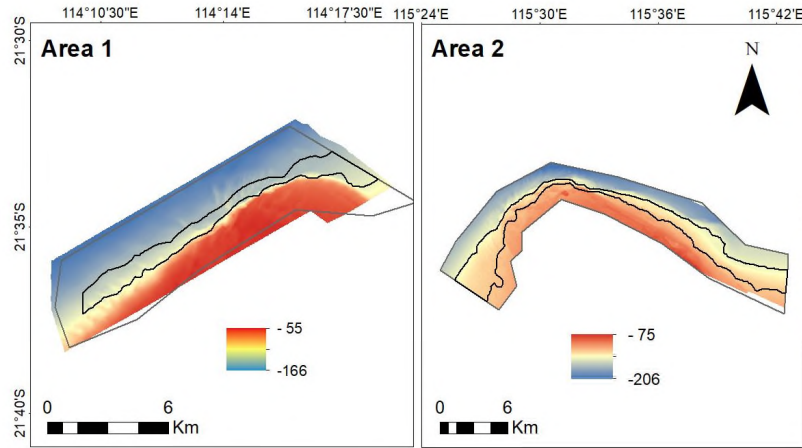|	
Macroalgae	SpongeEnc
HardCoral	Sponge
OtherOrg	Whip
Bryozoan	SoftCoral
Crinoid	Gorgonian
Hydroid	

Methods

- Predictor maps extracted from bathymetry data

- Either towed video or BRUVS data used to build and validate a model

- Machine learning techniques used to predict habitat types (benthos) & species richness (fish)

How does depth vary?

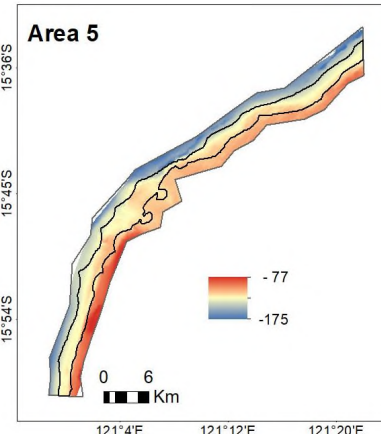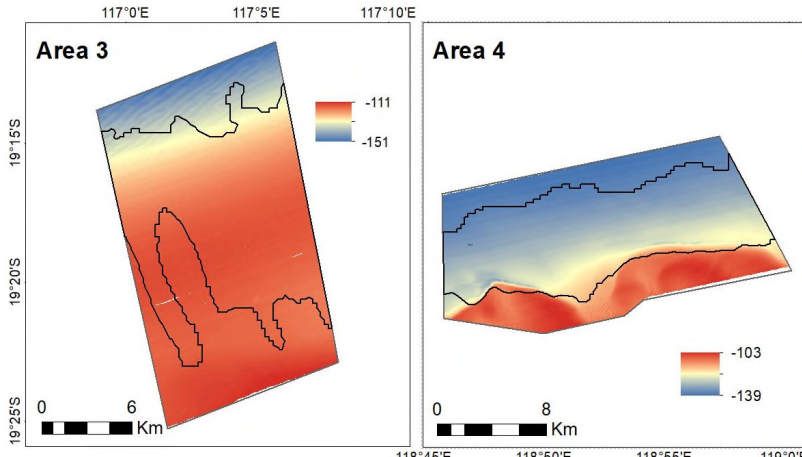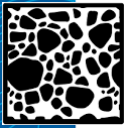

Study Area	Depth (m)		Slope (%)	
	Mean	Range	Max	Mean
1	-135	103	30.3	1.6
2	-140	111	32.8	1.5
3	-120	37	27.3	0.2
4	-125	34	13.8	0.3
5	-126	79	30	0.9

125 m Ancient Coastline KEF (AC125) contour
On
Off

- Multibeam sonar swathes collected in the field.
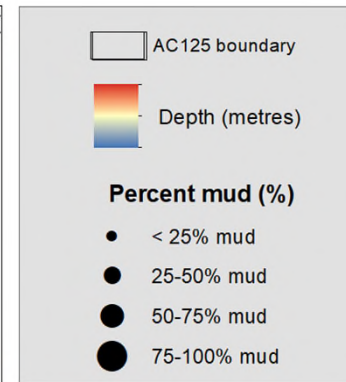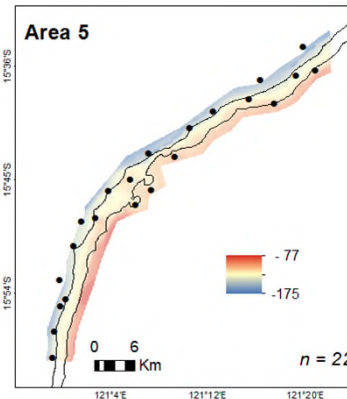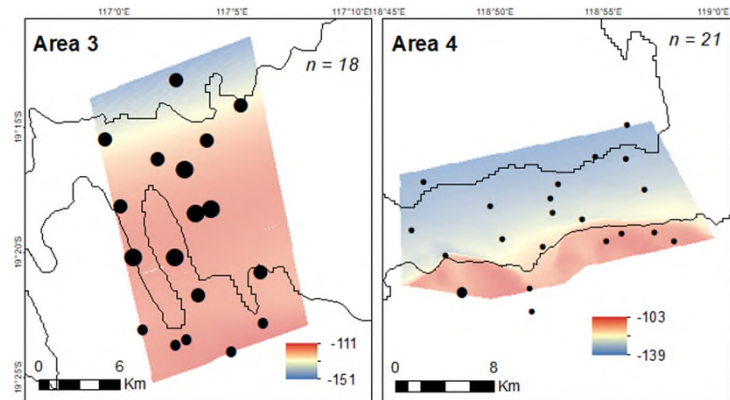
- "Fill in the gaps' using statistics to make depth maps.

- Area 3 & 4 – flattest

- Area 1 & 2 - steepest

Do hard substrates dominate?
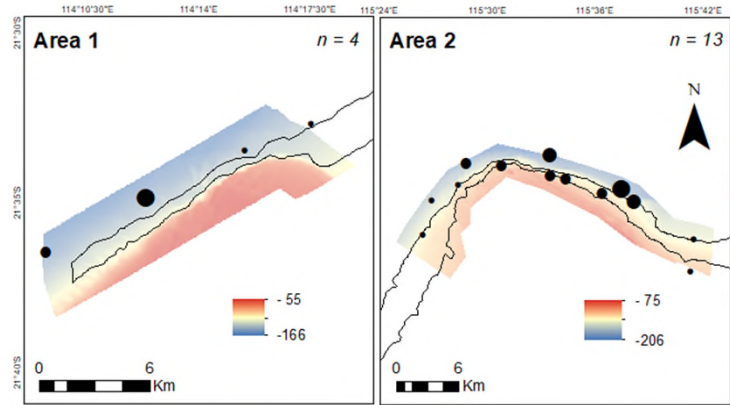
- Area 3 dominated by mud
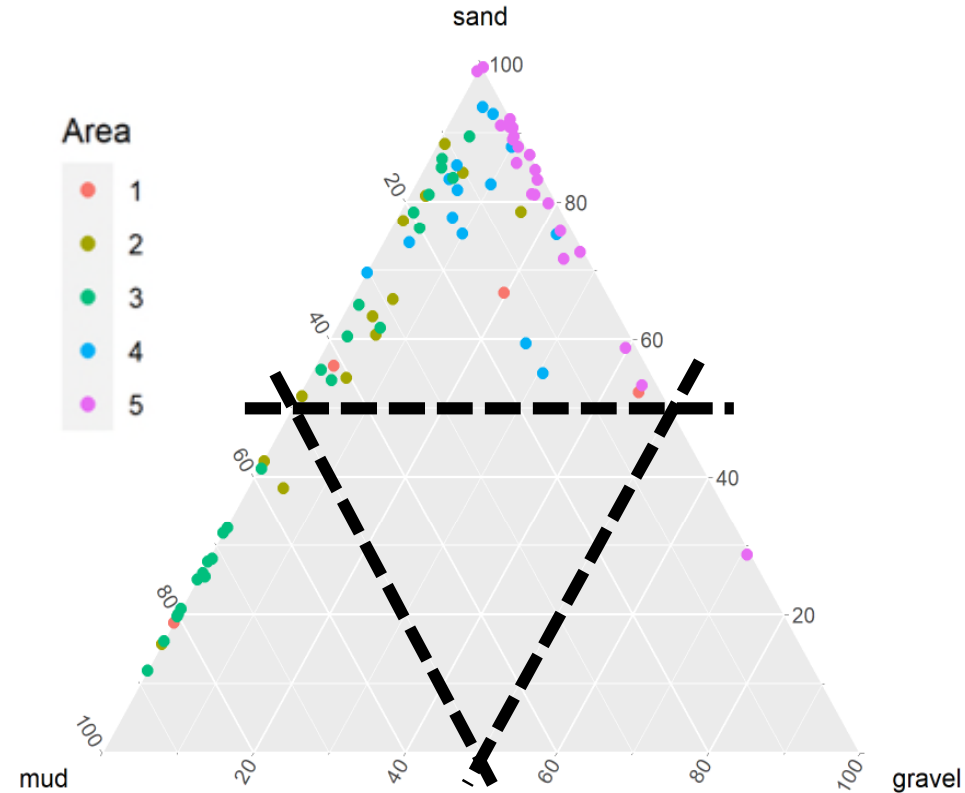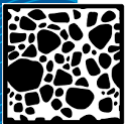- Mud rare in Areas 4 & 5
- Area 5 dominated by sand
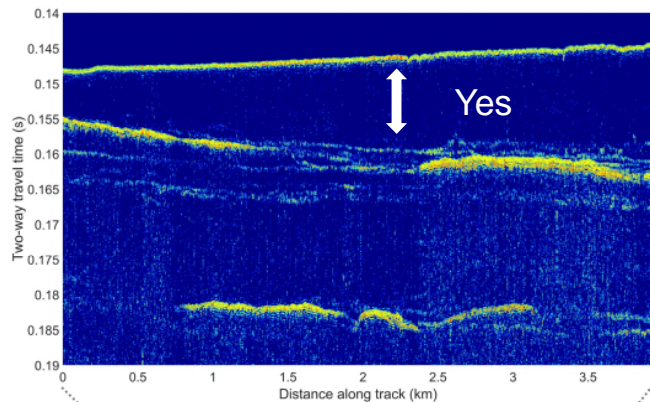
Do hard substrates dominate?

No

- Gravel is the most widespread in Area 5

- Mud most prevalent in Area 3

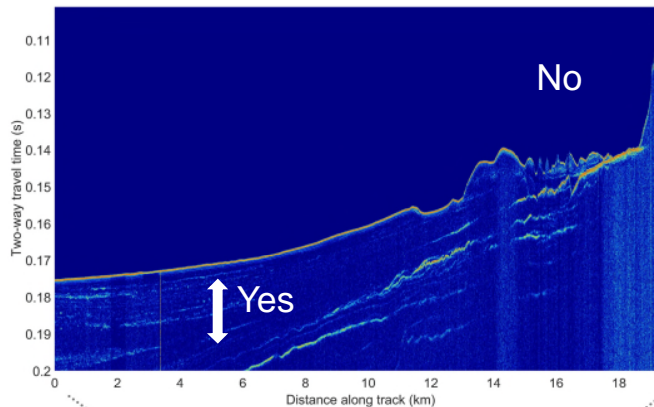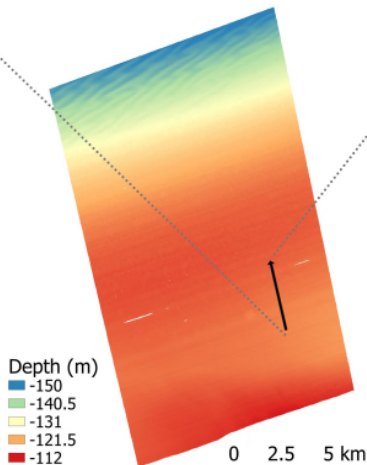- Other areas mainly a mix of sand and mud

Is the ancient shoreline buried?
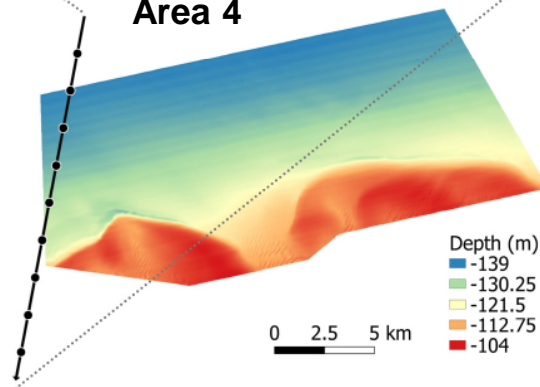

Yes

No

Yes

Area 3

Area 4

Depth (m)
-150
-140.5
-131
-121.5
-112

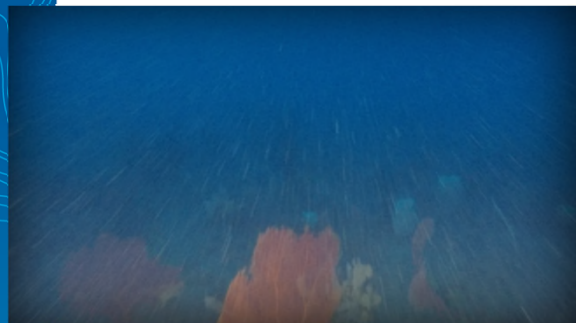Depth (m)
-139
-130.25
-121.5
-112.75
-104

0   2.5   5 km

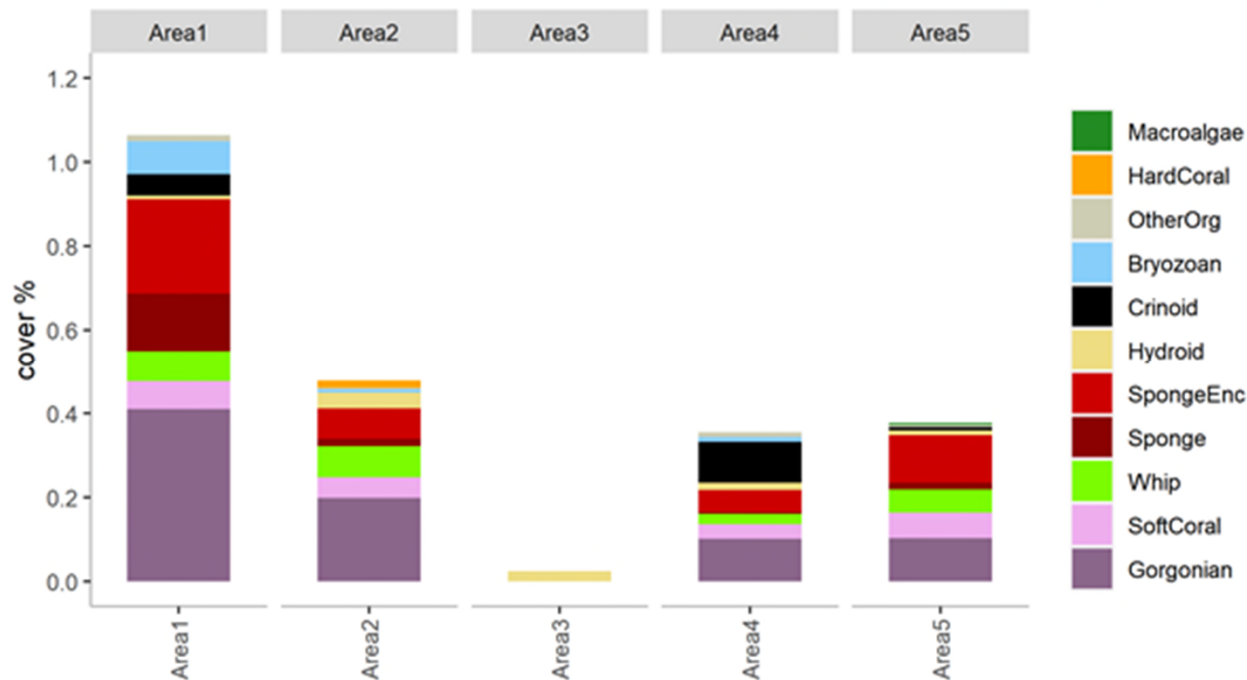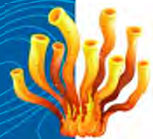- Likely yes in at least part of Area 3.

- Possible in the deeper parts of Area 4.

Patchy coverage of biota

Area 1

Area 3

Biota on and off the AC125
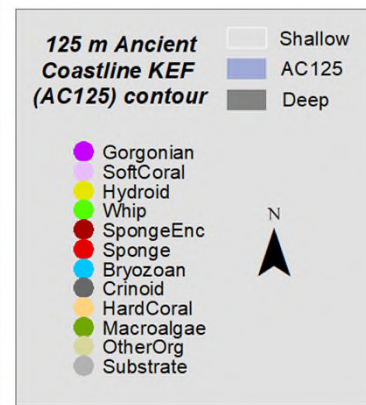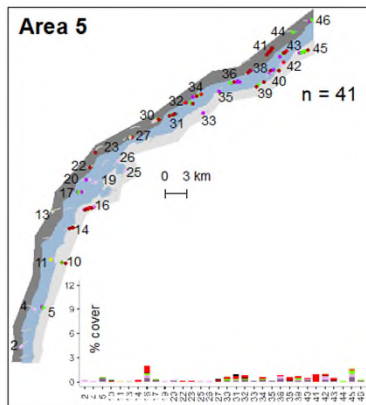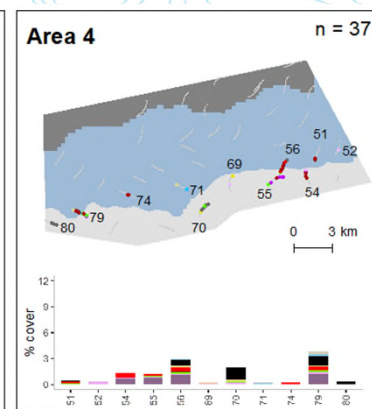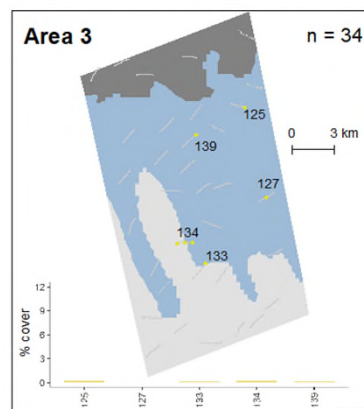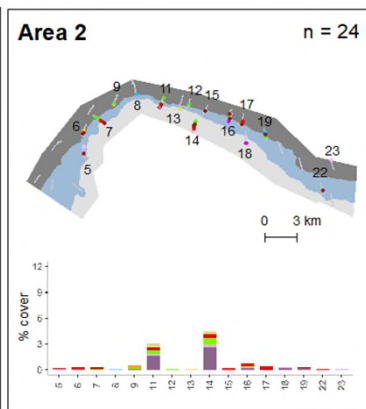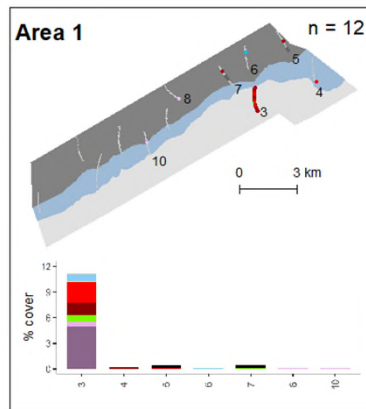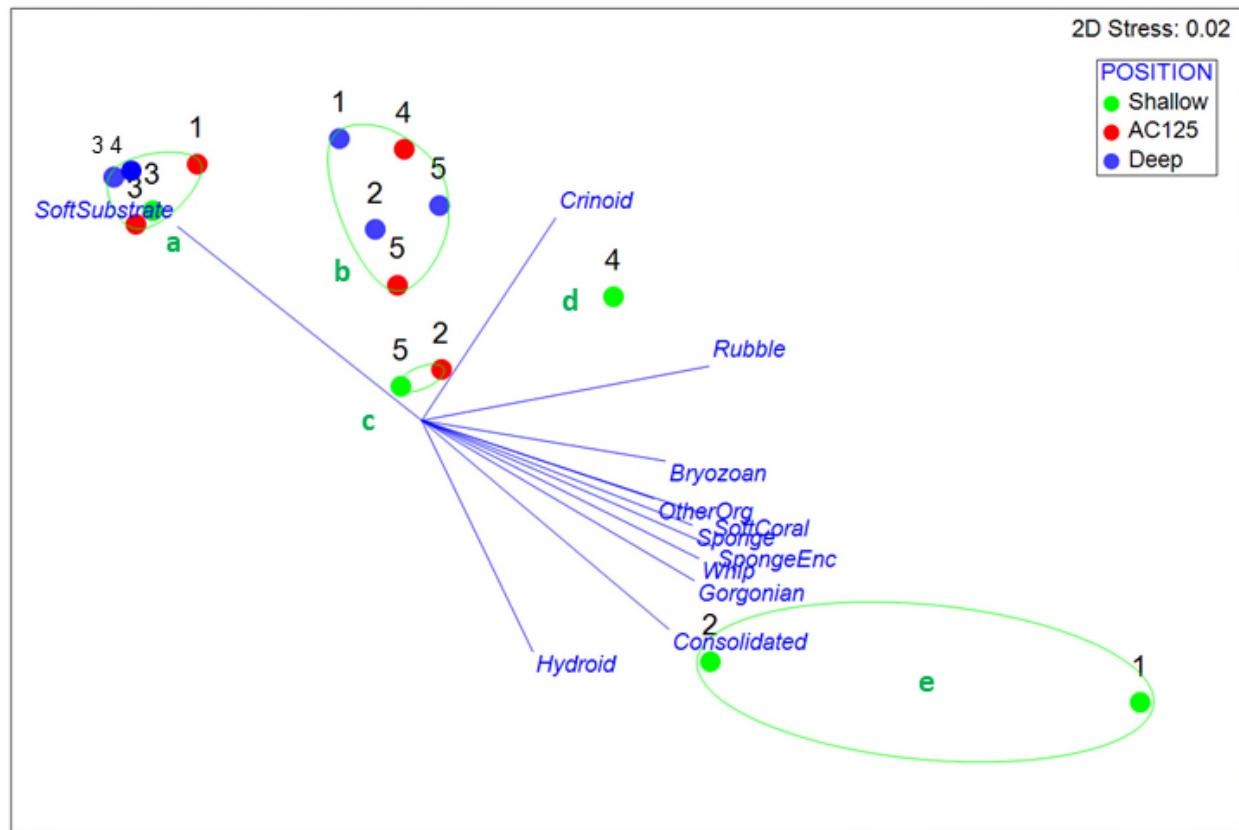

- The greatest concentration of biota found shallow of the KEF

- Area 3 particularly lacking in biota

- Most transects have low % biota – some have a diversity of groups
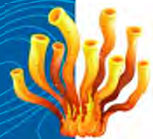
Which biota tend to cluster?

- Soft substrate in Areas 1, 3, 4 with few biota, rarely shallow

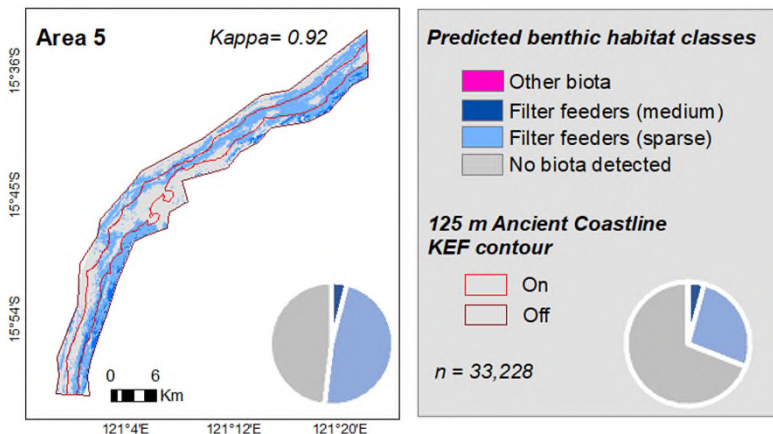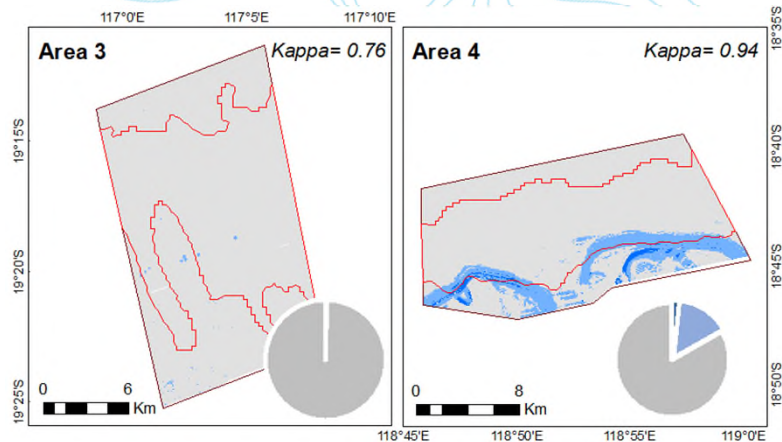- Most biota with consolidated substrate in Areas 1, 2, always shallow

Predictive maps of habitat

Predicted benthic habitat classes
- Other biota (magenta)
- Filter feeders (medium) (dark blue)
- Filter feeders (sparse) (light blue)
- No biota detected (grey)

125 m Ancient Coastline KEF contour
- On
- Off

n = 33,228
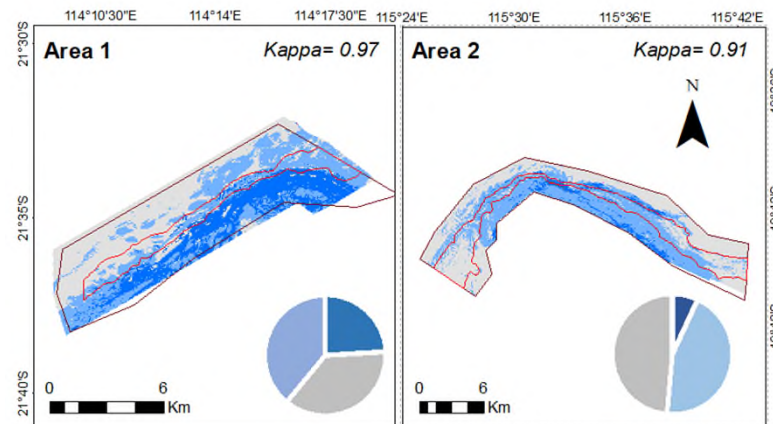
- Areas dominated by two classes of biota

- Area 3 particularly lacking in biota

- Much of the predicted biota located shallow of the KEF

Conclusions – Part 1

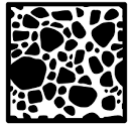Is the AC125 dominated by hard substrate and high structural complexity?

✗ Study areas are dominated by soft sediments.
Gravel and rubble was rare.
Ancient coastline may be buried in Areas 3 & 4.

Are benthic groups and habitats more abundant and diverse on the AC125 rather than in adjacent deeper or shallower waters?

✗ Benthic groups were more abundant & diverse shallow of the KEF.
Epibenthic habitats more likely shallow of the KEF.